
Decomposition and Construction of Higher-dimensional Neighbourhood Operations

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Abstract

We develop a method to construct morphological operations in higher-dimensional digital space from collection of one-dimensional set operations along digital isothetic lines in the space.

First, we prove that the $2n$ -neighbourhood in the n -dimensional digital space is decomposed into the $2(n-1)$ -neighbourhoods in the n $(n-1)$ -dimensional digital spaces.

Second, we derive a method to construct the object boundary in the n -dimensional digital space from the mutually orthogonal n digital boundaries in $(n-1)$ -dimensional digital spaces.

This decomposition and construction relation between fine and coarse dimensions implies that the object boundary in the n -dimensional digital space can be computed as the union of the endpoints of isothetic digital lines intersecting with the digital object in the digital space.

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